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SUGGESTIONS TO WOODLOT OWNERS IN THE OHIO VALLEY REGION.

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SUGGESTIONS TO WOODLOT OWNERS IN THE OHIO VALLEY REGION.

INTRODUCTION.

The purpose of this circular is to supply the great and increasing demand of farmers and others in the Ohio Valley region for information concerning the proper management of their timberlands. The Forest Service has made examinations of a large number of woodlots and forest tracts in this region, and the conclusions based on these investigations are embodied in this publication.

The Ohio Valley region includes Ohio, Indiana, southern Illinois, and northern Kentucky. Most of the information in this circular, however, will apply also to southeastern Iowa, northern Missouri, and the southern portions of Michigan and Wisconsin.

Originally this entire region was covered with a heavy stand of mixed hardwood timber. On the uplands the principal trees were oaks, hickories, sugar maple, white ash, yellow poplar, basswood, black walnut, black cherry, and beech. The lower-lying areas supported forests of elm, red maple, black ash, sycamore, willow, red and black gums, bur oak, hackberry, and cottonwood. In southern Indiana and Illinois the bald cypress and hardy catalpa had a limited distribution.

At the time of the settlement of this territory the forest was a serious hindrance to its development. It was necessary to cut off the trees to prepare the land for agriculture, and as there was at that time a very poor market for the timber much of the best of it was merely destroyed. The advent of railroads brought better market facilities and hastened the removal of the forests. Wagon, carriage, and furniture factories were rapidly established throughout the region, and for over forty years the Ohio Valley was the center of the hardwood industry.

PRESENT CONDITION AND STATUS OF THE WOODLOT.

Little remains of the original forest but detached, irregular bodies of woodland. In a few very hilly places along the Ohio River some comparatively large tracts of timber still exist; elsewhere the wooded portions consist of woodlots or woods pastures, usually in poor condition.

The custom has been to cut trees for special uses from time to time, leaving inferior trees in possession of the ground. As a result woodlots once thrifty and promising have degenerated into stands of crooked, defective, and otherwise undesirable trees. The valuable oaks, black walnut, white ash, and yellow poplar have been removed, and beech, ironwood, hornbeam, dogwood, and buckeye, of little worth, remain.

Most woodlots are used for pasturage and the ground has become covered with dense bluegrass sod. A heavy growth of grass not only tends to prevent the reproduction of valuable trees, but also robs the soil of moisture and smothers the roots of trees already growing.

The Ohio Valley region is preeminently agricultural, but while removal of timber in the interest of agriculture was essential to the development of the land, nevertheless the cutting has been carried to excess, and serious depletion of one of the most important resources of this part of the country has resulted. So little forest area now remains that the demands of the people must be largely supplied from the outside. Before long the exhaustion of forests in neighboring districts will cut off the supply which now tends to conceal the actual local shortage.

In 1899, Ohio, Indiana, and Illinois produced over 2 billion feet, or 25 per cent of the hardwood used in the United States. In 1906 they produced 1 billion, or only 14 per cent. They can never regain their lead, nor even maintain their present standing, for the supply is practically exhausted.

There is, however, sufficient waste land in the region adapted to forest growth, if properly employed, to provide an adequate and perpetual supply of timber for local uses and prevent the loss of many important industries.

USES OF THE WOODLOT.

A farm without a good woodlot is incomplete. In general not less than one-eighth of the total acreage of each farm should be devoted exclusively to timber growing. If properly managed the woodlot will supply the farmer with posts, fuel, building material, and some timber for market.

Every farmstead should be provided with protection from winds. For the live-stock grower, shielding the barnyard and feedlots will economize the grain necessary to fatten animals, since less food will be required to maintain the body warmth of the stock in winter. In summer a small part fenced off from the woodlot will afford cool shade to fattening animals, which lose flesh in very hot weather. A belt of forest trees will greatly reduce the danger of late frosts to the fruit blossoms of an orchard.

The woodlot should occupy the waste land not suitable for farm crops. Steep hillsides, ravines, swamps, sand dunes, creek banks, rocky slopes, and corners cut off by ditches, creeks, or railroads will sustain a good growth of timber and become an important source of revenue. Forest growth on steep slopes and river banks protects them from erosion by heavy rains and freshets. On a farm without waste land the woodlot should be so located as to afford the best protection. Strips at least 5 rods wide should be maintained along the windward side, usually the north and west, and in addition there should be a shelter belt around the house and farm buildings. Such timber tracts add materially to the attractiveness and sale value of the farm.

PROTECTION OF THE WOODS.

GRAZING.

The first requirement of a woodlot is protection. One of the principal sources of danger is grazing. Animals injure the trees directly by browsing on young seedlings and sprouts, breaking off shoots and buds, gnawing the bark of trees, trampling and breaking young growth, exposing and injuring roots, and eating the mast. Young trees suffer most, which makes it imperative to exclude stock from recent forest plantations and open stands where reproduction is desired.

The sharp hoofs of cattle cause loose sandy soil to become still looser through the destruction of the herbage which holds the soil together, while stiff soils are rendered more compact. Hillsides and drifting sands are most liable to injury, and even light grazing of such areas should not be permitted.

FIRE.

Constant care should be taken to keep fire from running through the woodlot. It is poor policy to burn off the leaves to improve the grazing, since the presence of grass in a forest indicates an unhealthy condition, and the destruction of the leaf litter and humus impoverishes the soil and retards tree growth, and young sprouts and seedlings, upon which the future of the woodlot depends, are often either destroyed or badly stunted.

It is not a single fire which causes the greatest loss, but the combined effects of many fires. One fire will scorch the bark of a tree and leave a small scar. Gradually, with each succeeding fire, the scars become deeper, until the trees are either burned completely through or are so weakened that they are easily thrown by the wind. Moreover, these scars afford openings for insects and rot-producing fungi, which not only destroy the tree first attacked, but become a source of infection for others.

Protection from fire in this region is usually not difficult. The watchfulness of the owner and of the men working about the place is the surest safeguard. Care should be taken in burning brush or clearing land to prevent the fire from spreading. If a railroad passes through the forest or near it, the right of way should be burned over occasionally and kept free from inflammable material. A furrow plowed along the edge of the woods near the track forms a good check.

WIND.

A fault with nearly all woodlots is the absence of a dense border as a protection from winds. The margin of a forest which has been unprotected from the time the trees were small is usually provided with its own windbreak mantle through the development of numerous branches on the exposed trees. If, however, the present margin was protected by a neighboring stand during its early years and has later been exposed, the woodlot is likely to suffer from windfall. Trees growing in dense forests depend upon their close association with other trees to withstand heavy winds. When the forest is suddenly opened the trees are not sufficiently stable to withstand the changed conditions, and many are blown down. This is especially apt to happen where the soil is wet, since trees growing in such ground have shallow root systems.

A strip a few rods wide along the exposed margins of the woods should be made and kept as dense as possible. The development of bushes and undergrowth should be encouraged. No trees of any kind should be removed from this protective strip except when there are others to take their places. Where such a windbreak is maintained it will be possible to make thinnings to the leeward with little danger of the remaining trees being blown down.

If a windbreak is planted, it is usually best to employ two species, one a rapid grower to afford early protection; the other of slow growth to make a permanent and more efficient shield. Carolina poplar, black walnut, and hardy catalpa make very quick growth, while any of the evergreen trees, such as Norway spruce, arbor-vitæ, or white pine can be planted in outside rows for permanent protection. The spacing should be 4 feet in rows 6 feet apart. When the trees begin to crowd badly, half of them should be removed.

WORK IN THE WOODS.

In cutting, the first precaution is to be careful of the young growth. One important object of forest management is to have new trees of the most useful kinds replace just as soon as possible those that are cut. Care should be taken in felling to see that each tree is thrown where it will not unnecessarily injure other trees or crush the young seedlings and sprouts upon which the future of the forest depends.

All stumps should be cut as low as possible, for high stumps needlessly waste the best timber of a sound tree. Branches too small for firewood should be scattered over the ground, especially in openings, where they will help to hold the leaf litter, keep out the grass, and in decaying enrich the soil. Along railroads, however, where there is especial danger from fire, all brush should be piled and burned at a time when there is least danger of the fire spreading beyond control.

Many trees, such as chestnut, basswood, catalpa, and many of the oaks and hickories, sprout very readily from the stump. The woodlot owner should take advantage of this tendency in order to secure quick reproduction. If stumps are cut very low and have the rough edges carefully trimmed off with an ax their sprouting capacity is greatly improved.

VALUE OF DIFFERENT SPECIES.

In managing his woodlot the owner should always favor the species which will be of greatest value for final crop. This will depend largely upon the uses to which the timber is to be put. For post or pole material, chestnut, Osage orange, catalpa, locust, and mulberry should be favored; for handle stock, white ash and hickory; for pulp, cottonwood, Carolina poplar, basswood, and willow; for firewood, beech, maple, hickory, and many other species; for lumber, white oak, yellow poplar, black walnut, white ash, black cherry, basswood, elm, and sugar maple.

The farmer should become familiar with the market before he sells timber and be sure that he gets full value. Stumpage prices have risen very rapidly during the last ten years and the chances are good for continued increase. Black walnut, yellow poplar, black cherry, and white oak are the most valuable trees in this region.

The following table will serve as a basis for estimating the value of standing timber. Very poor trees will be worth less than the minimum price given, while extra good material for special uses will command a price greater than the highest. It must also be remembered that timber difficult to get to market on account of the distance, bad roads, or steep hills, is not so valuable as that which is more favorably located.

Stumpage values in the Ohio Valley Region.

Species.	Price per M feet B.M.	Species.	Price per M feet B.M.
Black walnut	$25 to $75	Sugar maple	$5 to $15
Black cherry	25 to 60	Cottonwood	5 to 15
Yellow poplar	15 to 35	Red gum	5 to 15
White oak	10 to 30	Elm	5 to 15
White ash	10 to 25	Basswood	5 to 15
Hickory	10 to 25	Chestnut	5 to 10
Red oak	10 to 25	Beech	5 to 10

THE MODEL WOODLOT.

The model woodlot should contain the number of trees per acre consistent with the most rapid development of the best timber. Trees should stand close enough together in youth to stimulate growth in height and produce long, clear trunks. Later more space for each tree will be needed. Stands under 10 years of age may contain from 1,000 to 3,000 trees per acre. This number should be gradually diminished as the trees develop, until at maturity probably 200 of the original trees are left. Under natural conditions this thinning would be brought about through a struggle for supremacy in which the weaklings are killed out by the stronger and hardier trees. When artificial thinnings are made the energy usually wasted in this competition is employed in timber production, and the maturity of the crop is thereby hastened. And what is even more important, the composition of the stand and the quality of timber produced can be controlled by gradually removing the trees of inferior quality and kind.

There should be no large openings in the woods, for the crowns of the trees should be so close together that in summer little direct sunlight falls upon the ground. The soil should be loose, porous, rich in vegetable mold, and covered with leaves and litter to the exclusion of grass and light-demanding weeds. There should be an undergrowth of young trees to take the places of those that fail or are removed. The trees along the exposed margins of the woodlot should be covered with branches to the ground, so as to form a dense border to safeguard against damage by storms.

The amount of wood produced annually by a fully stocked thrifty stand of timber in this region depends upon the quality of the soil and the species of trees. Rapid growers on good soil may produce as much as 175 cubic feet per acre each year, which is equivalent to almost 2 cords of 4-foot wood. Medium soils fully stocked with the usual mixture of second-growth hardwoods will yield at most about 110 cubic feet, or $1\frac{1}{4}$ cords per acre. Of course, the poorer the condition of the woodlot the less the annual yield. It is doubtful if an acre of the average woodlot of this region produces more than one-half cord of wood per year under the present unsatisfactory conditions.

If the wood cut from the forest annually or at stated periods does not exceed the amount grown during the interval and care is taken to keep the ground fully stocked with thrifty young trees, the woodlot may be kept up indefinitely. The endeavor should be to ascertain about how much wood the area is each year capable of producing and to cut a little less than is grown, in order to be on the safe side. Thus, if an acre of woodlot is producing 1 cord of wood annually, it will be best to cut an amount not exceeding three-fourths of a cord per acre for each year. This represents the interest on the forest

capital. If the owner foresees that in any year it will be necessary to take out more than the equivalent of the annual growth, he should refrain from cutting in the preceding year or reduce his cuttings in following years until the excess is compensated.

IMPROVEMENT OF TYPICAL WOODLOTS.

In managing the woodlot the goal should be this model or ideal condition. In discussing the methods required to accomplish these results, four common types of woodlots will be described. In many instances more than one type will be found in a single woodlot. In such cases each condition should be treated according to the methods prescribed for the type to which it belongs.

DENSE FIRST-GROWTH FOREST.

A great many woodlots are merely parts of the old hardwood forest which have been preserved in their virgin condition. Many of the trees are large, with long, smooth trunks and compact crowns. Increase in height has practically ceased, and growth in diameter is very slow. The trees are mature, and many are deteriorating. Some are dry-topped or entirely dead, while others are crooked and unsound. Old logs on the ground are evidence of the waste which has resulted from lack of care. The openings made by the falling trees are being filled with young growth of various species, many of them undesirable for final crop. The margins of the lot are usually open and exposed to the wind, and a grassy sod is encroaching upon the forest floor.

In such stands the producing capacity is practically nothing, since the amount of wood formed annually is offset by the death and deterioration of the over-mature trees. The forest capital is virtually inactive and the returns in the form of increased stumpage values (due largely to the general decrease in timber supply) are counterbalanced by taxes, interest on investment, and decay of the trees. It is as poor economy to let timber waste in the woods as to allow a farm crop to rot in the field.

The first requirement is the removal of the dead, dying, and weed trees. A weed tree is one which occupies space in a forest but has comparatively little value. Such trees as water beech, ironwood, dogwood, scrub oak, and pawpaw may be classed as weeds and should be cut out.

When the trees to be removed occur in groups they should not all be cut out immediately, as this would leave large gaps in the forest cover and subject the remaining trees, which have been suddenly exposed, to the danger of windfall. The dead and dying trees should be taken out first, next the weed trees, and then those which are crowding the best timber producers. The work should be done gradually

and extended over a period of years. In general, it is not safe to cut out more than one-fifth of a stand at one time, or to cut over the same ground oftener than once in five years.

Where several good trees crowd each other, those with the smallest crowns, those which appear least thrifty, and those which in the opinion of the owner have attained their highest commercial value should be removed. The object should be to leave the sound and thrifty trees, which will continue to increase in value, and to have them well distributed over the tract.

It is important to maintain the humus and ground moisture in every upland forest. No thinnings should be so severe that grass will enter before the openings are filled with young growth. The presence of briers in openings does not seriouly interfere with the reproduction and is much to be preferred to a grassy sod.

If the woodlot borders on open land it should not be thinned for a distance of at least 2 rods from its edge. If the margin is open the growth of young trees and shrubs should be encouraged, and if necessary a windbreak should be planted.

MATURE OPEN STAND.

A large proportion of the woodlots in this region are remnants of the original forest which have received no care or attention. They are the woods pastures common to so many farms. It has been the usual practice to cut the most valuable trees as they were needed or as opportunity occurred for disposing of the product to advantage. The straightest-grained and easiest-splitting trees were felled for firewood instead of those whose removal would improve the forest.

As a result of constant grazing the ground is covered with a dense sod to the exclusion of desirable young growth. The standing trees are usually mature, growing in clumps or sparsely scattered over the lot. Many of them are dry-topped, diseased and scraggy. Very often the species are of little value. If reproduction occurs it is very irregular and composed mostly of weed species.

The proper treatment of such a stand depends on the degree to which it has deteriorated, upon its location, and upon the farmers' need for fuel and pasture. If the woods pasture is located on land valuable for agriculture, and the rejuvenation of the old forest is impracticable, it probably will be the best policy to remove the timber and lay out the ground into permanent fields. Since every well-regulated farm, however, should possess some timberland, new plantations are recommended. Waste land should be utilized for this purpose.

The first step in the improvement of an open and grass-grown woodlot is the exclusion of live stock. If all of the lot can not be spared for timber growing alone, it will be better to fence off the

thriftiest part of it as a forest reserve from which all animals should be excluded. The other portion can be cleared of most of its trees and the pasture greatly improved by their removal. In this way better timber can be grown and better pasture secured than by trying to combine the two.

Another step is the removal of the dead and badly diseased trees and those whose reproduction is not desired. The remaining trees will seed up the openings and provide for natural regeneration. If other species are desired, it will be necessary to plant them. Young seedlings for this purpose can be secured from other parts of the forest, or nuts and acorns can be planted. The best time to plant is in early spring.

The next process is the preparation of the soil for seeding and restoration to the natural forest condition. The sod should be broken up by means of a bull-tongue plow or a disk harrow. Another very effective method is to allow swine to uproot it. In rooting they will bury enough acorns and nuts to insure a good crop of seedlings. Only enough swine to devour part of the mast should be allowed in the lot. A rank growth of weeds and briers probably will spring up at first, but the development of the seedlings will not be seriously retarded by it. In a very short time the young trees will take possession of the soil, and if they are protected from fire and grazing will rapidly establish good forest conditions.

As soon as good reproduction is secured the remaining mature trees may be removed. It is usually good policy, however, to retain a few large trees to supply special needs of the farm. In removing them care should be exercised to inflict as little damage as possible to the young growth.

The planting of a shelterbelt along the exposed margins of the woodlot is highly desirable.

DENSE YOUNG STAND.

There are a great many dense second-growth woodlots in this region. The original forest was cut over and all the merchantable timber removed. The remaining trees seeded up the land and the second growth was allowed to develop without attention. The trees range in size from 4 to 12 inches in diameter and from 25 to 50 feet in height. Most of the trees are fairly straight and thrifty, but many are suppressed and dying. In some instances there are dense groups so evenly matched in size of growth that the development of all is temporarily arrested.

The composition of each stand varies with the kinds of trees which seeded up the area. Very often there is a considerable proportion of weed trees. Occasional old trees remain from the first cutting; they are usually crooked, limby, and defective. Old beech trees espe-

cially are apt to be scraggy and bushy-topped and to interfere with the crowns of neighboring trees. The relative amount of space occupied by them is very great and out of all proportion to their importance. Reproduction in their dense shade is scarce and stunted. Fires have not been carefully kept out and the butts of most of the trees are more or less severely fire scarred.

In such stands an improvement cutting is needed; that is, the removal of the trees which are a hindrance to the highest productive capacity of the soil. This class includes the dead, crooked, and diseased trees, together with weed trees, grapevines, and all growth which the woodlot would be better off without. As a rule this material can be used for firewood, but it will pay to spend the time and labor necessary to make improvement thinnings, even if they can not be profitably utilized at all, for the improved condition of the timber land will justify their removal.

The dense stands need thinning. This should not be undertaken, however, without a clear understanding of its objects.

Trees which have grown in the open, where all of their limbs have had abundant light, are branched either quite to the ground or to within a short distance of it. But in the forest the lower branches die from want of light and are later broken off by the wind or forced off by the growth of wood about their base. Hence a typical forest tree has a long, clear trunk and a short, compact crown.

The amount of wood which a tree produces depends upon the area of leaf surface exposed to sunlight; the larger the leaf surface, the larger the amount of wood produced. Opening up a dense stand will give the healthy trees more light and growing space and cause them to develop more extensive root systems, which will support more foliage and, in consequence, produce more wood.

The farmer is interested not merely in the amount of wood produced but in the production of timber which will yield wide clear lumber as well. This can be accomplished by allowing dense stands at first and later removing part of the trees.

Trees which are crowded while young try to get their crowns into the sunlight and consequently produce long, slim stems. When straight trunks of sufficient height have been obtained, thinning gives room for increased root and foliage development This is followed by increased wood production. And since the incentive for height growth has been removed, the new wood tissue goes to increase the diameter of the tree.

In thinning a stand, those trees should be left which will be most valuable for final crop, and those removed which have the smallest crowns, show signs of deterioration, or are of less valuable species.

Frequent light thinnings will give the best results. Each tree left standing should have a small clear space between its crown and those

of its nearest neighbors, but the openings should never be so large that grass will cover the soil before they close.

SAPLING THICKET.

Thickets are common on cut-over lands and abandoned pastures. The trees may vary from 3 to 25 feet in height and in diameter up to 4 inches. They may be in dense stands or in clumps scattered over the tract.

In such stands cleanings are needed to eliminate the undesirable species before they gain control of the stand and to remove trees of the better kind where the crowding becomes too severe. As a rule these cleanings should be made when the most serious crowding begins, which will be when the trees are from 10 to 15 years old. In general, no openings in the crown cover should be made that will not close in three or four years; that is, not more than 2 or 3 feet of open light space should be left between the tops of the trees remaining. The spacing in the stand should be from 6 to 9 feet each way, though of course the arrangement will be irregular. The material removed may have a value for hop and bean poles or barrel hoops, or part of it may be large enough for firewood. A second cleaning should be made as soon as the trees have begun to crowd seriously again, which will be about ten years after the first. The timber removed this time will probably have considerable value for firewood, posts, stakes, and other uses.

In a very young stand that is not dense throughout it is often advisable to leave some of the weed trees, provided they do not interfere with better species. They will be useful in preventing large openings in the crown cover and in inducing height growth and self-pruning. Of course they should be the first removed in the next cutting.

The principles upon which later thinnings are made are the same as those which apply to dense young stands.

All of these suggestions for the management of the woodlot are entirely practicable and are being carried out successfully on a great many farms in this region. With a little care and foresight every farmer can make his woodlands a valuable and attractive asset to his farm.

Approved:

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *December 6, 1907.*

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